

WHAT IS CLAIMED IS:

1. A system for treating the surface of an optical lens, said system comprising:

an entry chamber having a first entrance gate and  
5 a first exit gate, said first entrance gate and said first exit gate sealing said entry chamber when closed, and said entry chamber including a conveyor extending between said first entrance gate and said first exit gate;

10 a first negative pressure source in selective communication with said entry chamber;

a coating chamber having a second entrance gate and a second exit gate, said second entrance gate and said second exit gate sealing said coating chamber  
15 when closed, and said coating chamber including at least a pair of spaced apart electrodes disposed therein and a conveyor extending between said second entrance gate and said second exit gate so that said conveyor conveys said lens between said electrodes;

20 a source of plasma gas in communication with said coating chamber to introduce said gas into said coating chamber;

a second negative pressure source in communication with said coating chamber;

25 an electrical power source in communication with said electrodes to apply a predetermined electrical potential at each said electrode so that, upon establishment of a predetermined pressure in said coating chamber by said second negative pressure  
30 source, a plasma cloud of said gas is established between said electrodes;

an exit chamber having a third entrance gate and a third exit gate, said third entrance gate and said

third exit gate sealing said exit chamber when closed and said exit chamber including a conveyor extending between said third entrance gate and said third exit gate; and

5        a third negative pressure source in selective communication with said exit chamber,

         wherein said entry chamber communicates with said coating chamber through said first exit gate and said second entrance gate so that said entry chamber  
10        conveyor and said coating chamber conveyor communicate to pass said lens from said entry chamber to said coating chamber, and

         wherein said coating chamber communicates with said exit chamber through said second exit gate and  
15        said third entrance gate so that said coating chamber conveyor and said exit chamber conveyor communicate to pass said lens from said coating chamber to said exit chamber.

         2.    The system as in claim 1, wherein said gas  
20        is a plasma polymerizable gas.

         3.    The system as in claim 1, wherein said entry chamber includes

         an entry lock chamber,  
         an entry hold chamber upstream from said  
25        entry lock chamber and in communication with said coating chamber by said first exit gate and said second entrance gate, and

         a gate disposed between said entry hold chamber and said entry lock chamber so that said entry  
30        lock chamber and said entry hold chamber are sealed from each other when said gate therebetween is closed,

         said first negative pressure source is in selective communication with each of said entry lock chamber and said entry hold chamber, and



5 a drying chamber upstream from said entry chamber  
and in communication with said entry chamber by said  
first entrance gate, said drying chamber including a  
conveyor extending between an entrance to said drying  
chamber and said first entrance gate, and

a gas source in communication with said drying  
chamber so that said gas source provides a gas having  
a predetermined relative humidity to an interior area  
of said drying chamber.

10 10. The system as in claim 9, wherein said  
drying chamber includes a series of tandemly arranged  
subchambers.

15 11. The system as in claim 1, including a  
control system in operative communication with said  
entry chamber conveyor, said coating chamber conveyor,  
said exit chamber conveyor, said first negative  
pressure source, said second negative pressure source,  
said third negative pressure source, said gas source,  
said first exit gate, said second entrance gate, said  
20 second exit gate and said third entrance gate, said  
control system configured to

activate said second negative pressure  
source to maintain said predetermined pressure in said  
coating chamber,

25 activate said gas source to maintain said  
gas in said coating chamber,

activate said entry chamber conveyor to move  
said lens into said entry chamber when said entry  
chamber is at ambient pressure and said first exit  
30 gate is closed,

thereafter, when said first entrance gate is  
closed, activate said first negative pressure source  
to bring an area within said entry chamber adjacent  
said first exit gate to said predetermined pressure,





source, a plasma polymerization cloud of said gas is established between said electrodes;

an exit chamber having a third entrance gate and a third exit gate, said third entrance gate and said  
5 third exit gate sealing said exit chamber when closed and said exit chamber including a conveyor extending between said third entrance gate and said third exit gate;

a third source of said plasma-polymerizable gas  
10 in selective communication with said exit chamber to introduce said gas into a portion of said exit chamber adjacent said third entrance gate;

a third negative pressure source in selective communication with said exit chamber,  
15 wherein said entry chamber communicates with said coating chamber through said first exit gate and said second entrance gate so that said entry chamber conveyor and said coating chamber conveyor communicate to pass said lens carrier from said entry chamber to  
20 said coating chamber, and

wherein said coating chamber communicates with said exit chamber through said second exit gate and said third entrance gate so that said coating chamber conveyor and said exit chamber conveyor communicate to  
25 pass said lens carrier from said coating chamber to said exit chamber; and

a control system in operative communication with said entry chamber conveyor, said coating chamber conveyor, said exit chamber conveyor, said first  
30 negative pressure source, said second negative pressure source, said third negative pressure source, said first gas source, said second gas source, said third gas source, said first exit gate, said second

entrance gate, said second exit gate and said third entrance gate, said control system configured to activate said second negative pressure source to maintain said predetermined pressure in said coating chamber,

activate said second gas source to maintain said gas in said coating chamber,

activate said entry chamber conveyor to move said lens carrier into said entry chamber when said entry chamber is at ambient pressure and said first exit gate is closed,

thereafter, when said first entrance gate is closed, activate said first negative pressure source said first gas source to fill said area adjacent said first exit gate with said gas and to bring said entry chamber adjacent portion to said predetermined pressure,

thereafter open said first exit gate and said second entrance gate and activate said entry chamber conveyor and said coating chamber conveyor to move said lens carrier from said entry chamber into said coating chamber and between said electrodes,

activate said third negative pressure source and said third gas source to fill said exit chamber adjacent portion with said gas and to bring said exit chamber adjacent portion to said predetermined pressure,

thereafter open said second exit gate and said third entrance gate and activate said coating chamber conveyor and said exit chamber conveyor to move said lens carrier from said coating chamber to said exit chamber, and

thereafter close said third entrance gate.





said fourth gate and said fifth gate sealing said exit chamber when closed;

5 a third conveyor disposed in said entry buffer chamber, said coating chamber and said exit buffer chamber and extending between said third gate and said fourth gate;

10 a pair of spaced apart electrodes disposed in said coating chamber so that said third conveyor conveys a carrier of said lenses between said electrodes;

15 an electrical power source in communication with said electrodes to apply a predetermined electrical potential at each said electrode so that, upon establishment of a first predetermined pressure in said second chamber by said coating chamber negative pressure source, a plasma polymerization cloud of said gas is established between said electrodes;

20 a fourth conveyor disposed in said exit chamber and extending between said fourth gate and said fifth gate;

25 a respective negative pressure source in communication with each of said entry lock chamber, said entry hold chamber, said entry buffer chamber, said coating chamber, said exit buffer chamber and said exit chamber;

30 a respective source of plasma-polymerizable gas in selective communication with each of said entry hold chamber, said entry buffer chamber, said coating chamber, said exit buffer chamber and said exit chamber to introduce said polymerizable gas therein;

a first vent source in communication with said entry lock chamber to introduce a vent gas therein; and

a second vent source in communication with said exit hold chamber to introduce a vent gas therein,

wherein said entry lock chamber communicates with said entry hold chamber through said second gate so that said first conveyor and said second conveyor communicate to pass said lens carrier from said entry lock chamber to said entry hold chamber,

wherein said entry hold chamber communicates with said entry buffer chamber through said third gate so that said second conveyor and said third conveyor communicate to pass said lens carrier from said entry hold chamber to said entry buffer chamber, and

wherein said exit buffer chamber communicates with said exit chamber through said fourth gate so that said third conveyor and said fourth conveyor communicate to pass said lens carrier from said exit buffer chamber to said exit chamber.

20. The system as in claim 19, including a control system in operative communication with said first, second, third and fourth conveyors, said respective negative pressure sources, said respective sources of plasma polymerizable gas, said first, second, third and fifth gates and said first and second vent sources, said control system configured to

activate said respective negative pressure sources in communication with said entry buffer chamber, said coating chamber and said exit buffer chamber to maintain said first predetermined pressure therein,

activate said respective source of plasma polymerizable gas to maintain said gas in said entry buffer chamber, said coating chamber and said exit buffer chamber,









(J) providing an exit chamber downstream from said coating chamber;

(K) introducing said gas into at least a portion of said exit chamber adjacent said coating chamber and  
5 bringing said at least a portion of said exit chamber to said first predetermined pressure; and

(L) moving said first lens from said coating chamber to said exit chamber.

26. The method as in claim 25, wherein said gas  
10 is a plasma polymerizable gas.

27. The method as in claim 25, including,  
following moving said first lens into said coating chamber in step (I), sealing said entry chamber from said coating chamber, bringing at least a portion of  
15 said entry chamber to ambient pressure, bringing a second said lens into said entry chamber, and thereafter performing steps (G) through (L) with respect to said second lens.

28. The method as in claim 25, wherein  
20 step (E) includes providing said entry chamber having an entry lock chamber and an entry hold chamber, said entry hold chamber being in communication with said coating chamber and said entry lock chamber being upstream from and in communication  
25 with said entry hold chamber,

step (F) includes moving said first lens into said entry lock chamber,

said method includes, following step (F), the steps

30 (M) bringing said entry lock chamber and said entry hold chamber to a second predetermined pressure,

(N) bringing said entry lock chamber into communication with said entry hold chamber and moving



said lens from said entry lock chamber into said entry hold chamber, and

(O) sealing said entry hold chamber from said entry lock chamber,

5 step (G) includes introducing said gas into said entry hold chamber and bringing said entry hold chamber to said first predetermined pressure,

step (H) includes bringing said entry hold chamber into communication with said coating chamber, and

step (I) includes moving said first lens from said entry hold chamber into said coating chamber and through said cloud.

29. The method as in claim 28, wherein said first predetermined pressure and said second predetermined pressure are unequal.

30. The method as in claim 25, wherein step (B) includes providing a plurality of pairs of said spaced apart electrodes tandemly arranged in said coating chamber.

31. The method as in claim 25, wherein step (J) includes providing said exit chamber having an exit hold chamber and an exit lock chamber, said exit hold chamber being in communication with said coating chamber and said exit lock chamber being downstream from and in communication with said exit hold chamber,

step (K) includes introducing said gas into said exit hold chamber and bringing said exit hold chamber to said first predetermined pressure; and

step (L) includes bringing said exit hold chamber into communication with said coating chamber and moving said first lens into said exit hold chamber, and

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said method includes, following step (L), the steps

(M) evacuating said gas from said exit hold chamber,

5 (N) bringing said exit lock chamber to a pressure equal to the pressure in said exit hold chamber,

(O) bringing said exit hold chamber into communication with said exit lock chamber and moving  
10 said lens from said exit hold chamber into said exit lock chamber, and

(P) sealing said exit lock chamber from said exit hold chamber.

32. The method as in claim 25, wherein  
15 including, following moving said first lens into said exit chamber in step (L) and moving said second lens into said entry chamber, sealing said exit chamber from said coating chamber, bringing a portion of said exit chamber in which said first lens is located to  
20 ambient pressure, opening said coating chamber to said entry chamber, and bringing said second lens into said coating chamber.

33. A method for applying a polymer coating to optical lenses, said method comprising the steps of:

25 (A) providing said optical lenses on a plurality of carriers;

(B) providing a coating chamber including a plurality of pairs of spaced apart electrodes disposed in tandem therein;

30 (C) maintaining a plasma polymerizable gas in said coating chamber;

(D) maintaining a first predetermined pressure in said coating chamber and a predetermined electric potential at each said electrode so that a plasma

polymerization cloud of said gas is established  
between said electrodes in each said pair of  
electrodes;

(E) providing an entry hold chamber upstream  
5 from said coating chamber;

(F) providing an entry lock chamber upstream  
from said entry hold chamber;

(G) moving a first said carrier into said entry  
lock chamber;

10 (H) sealing said entry lock chamber and  
thereafter bringing said entry lock chamber to a  
second predetermined pressure;

(I) bringing said entry hold chamber to said  
second predetermined pressure;

15 (J) opening said entry hold chamber to said  
entry lock chamber and moving said first carrier from  
said entry lock chamber into said entry hold chamber;

(K) following step (J), sealing said entry hold  
chamber from said entry lock chamber, introducing said  
20 gas into said entry hold chamber and bringing said  
entry hold chamber to said first predetermined  
pressure;

(L) following step (J), bringing said entry lock  
chamber to ambient pressure, bringing a second said  
25 carrier into said entry lock, and repeating said  
method beginning at step (H) with respect to said  
second carrier and for a desired number of subsequent  
said carriers;

(M) following step (K), opening said coating  
30 chamber to said entry hold chamber and moving said  
first carrier into said coating chamber and through  
said plasma clouds;

(N) after said first carrier is removed from  
said entry hold chamber in step (M), sealing said

entry hold from said coating chamber and said entry lock chamber and returning to step (I) with respect to said second carrier

(O) providing an exit chamber downstream from  
5 said coating chamber;

(P) introducing said gas into at least a portion of said exit chamber adjacent said coating chamber and bringing said at least a portion of said exit chamber to said predetermined pressure; and

10 (Q) moving said first carrier from said coating chamber to said exit chamber.

34. A system for treating the surface of an optical lens, said system comprising:

an entry chamber having a first entrance gate and  
15 a first exit gate, said first entrance gate and said first exit gate sealing said entry chamber when closed, and said entry chamber including means for conveying said lens between said first entrance gate and said first exit gate;

20 means for selectively applying negative pressure to said entry chamber;

a coating chamber having a second entrance gate and a second exit gate, said second entrance gate and said second exit gate sealing said coating chamber  
25 when closed;

means for introducing a plasma gas into said coating chamber;

means for applying negative pressure to said coating chamber;

30 means for maintaining a plasma cloud of said gas in said coating chamber;

means for conveying said lens through said cloud;

an exit chamber having a third entrance gate and a third exit gate, said third entrance gate and said

third exit gate sealing said exit chamber when closed and said exit chamber including a means for conveying said lens between said third entrance gate and said third exit gate; and

5 means for selectively applying negative pressure to said exit chamber,

wherein said entry chamber communicates with said coating chamber through said first exit gate and said second entrance gate so that said entry chamber  
10 conveying means and said coating chamber conveying means communicate to pass said lens from said entry chamber to said coating chamber, and

wherein said coating chamber communicates with said exit chamber through said second exit gate and  
15 said third entrance gate so that said coating chamber conveying means and said exit chamber conveying means communicate to pass said lens from said coating chamber to said exit chamber.

35. A continuous method for treating the surface  
20 of optical lenses, said method comprising the steps of:

- (A) providing said optical lenses in batches,
- (B) providing a coating chamber including a pair of spaced apart electrodes disposed therein,  
25 and
- (C) maintaining a plasma gas in said coating chamber,

wherein said plasma gas is continuously maintained in said coating chamber between said  
30 batches, and said plasma gas produced from a process gas containing oxygen.

36. A system for treating the surface of an optical lens, said system comprising:

an entry chamber;  
a coating chamber downstream from said entry chamber and including a pair of spaced apart electrodes disposed therein;

5 an exit chamber downstream from said coating chamber;

a conveyor extending through said entry chamber, said coating chamber and said exit chamber so that said conveyor conveys said lens between said  
10 electrodes;

a source of plasma gas in communication with said coating chamber to introduce said gas into said coating chamber;

a negative pressure source in communication with  
15 said entry chamber, said coating chamber and said exit chamber;

an electrical power source in communication with said electrodes so that, upon introduction of said gas in said coating chamber by said gas source and upon  
20 establishment of a predetermined pressure in said coating chamber by said negative pressure source and of a predetermined potential at each said electrode, a plasma cloud of said gas is established between said electrodes; and

25 a control system in communication with said negative pressure source, said entry chamber, said coating chamber, said exit chamber and said conveyor, said control system configured to move said lens through each said chamber by said conveyor, to  
30 selectively seal said entry chamber from said coating chamber and said exit chamber from said coating chamber and to selectively pressurize and depressurize said entry chamber and said exit chamber.